CLAIMS

What is claimed is:

1. A pulse-by-pulse optical absorption apparatus, comprising:
(a) a cavity;
(b) a light source for delivering a pulse into said cavity;
(c) a time resolving means for resolving at least one response pulse produced by said cavity in response to said pulse; and
(d) a detector for detecting an intensity of said at least one response pulse produced by said time resolving means.

2. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said light source is an ultra fast light source and said pulse is an ultra short pulse.

3. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said at least one response pulse is at least one ultra short response pulse and said time resolving means is an ultra fast time resolving means.

4. The pulse-by-pulse optical absorption apparatus of claim 3, wherein said ultra fast time resolving means further comprises a nonlinear medium for mixing said at least one ultra short response pulse with a resolving pulse.

5. The pulse-by-pulse optical absorption apparatus of claim 4, wherein said resolving pulse is a chirped pulse.

6. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said at least one response pulse is at least one ultra short response pulse and said detector is an ultra fast detector.

7. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said at least one response pulse comprises a train of response pulses.

8. The pulse-by-pulse optical absorption apparatus of claim 7, wherein said detector further comprises a comparing device for comparing at least two said response pulses from said train of response pulses.

9. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said cavity is a linear cavity with a predetermined cavity length set to resolve said at least one response pulse at said detector.

10. The pulse-by-pulse optical absorption apparatus of claim 9, wherein said cavity length is on the order of micrometers to set a time regime of said at least one response pulse on the order of femtoseconds.

11. The pulse-by-pulse optical absorption apparatus of claim 9, wherein said cavity length is on the order of millimeters to set a time regime of said at least one response pulse on the order of picoseconds.

12. The pulse-by-pulse optical absorption apparatus of claim 9, wherein said cavity length is on the order of meters to set a time regime of said at least one response pulse on the order of nanoseconds.

13. The pulse-by-pulse optical absorption apparatus of claim 9, wherein said cavity comprises at least one low reflector.

14. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said cavity is a non-linear cavity with a predetermined cavity length set to resolve said at least one response pulse at said detector.

15. The pulse-by-pulse optical absorption apparatus of claim 14, wherein said cavity length is on the order of micrometers to set a time regime of said at least one response pulse on the order of femtoseconds.

16. The pulse-by-pulse optical absorption apparatus of claim 14, wherein said cavity length is on the order of millimeters to set a time regime of said at least one response pulse on the order of picoseconds.

17. The pulse-by-pulse optical absorption apparatus of claim 14, wherein said cavity length is on the order of meters to set a time regime of said at least one response pulse on the order of nanoseconds.

18. The pulse-by-pulse optical absorption apparatus of claim 14, wherein said non-linear cavity comprises at least one low reflector.

19. The pulse-by-pulse optical absorption apparatus of claim 1, wherein said cavity comprises an absorption sample whose absorption properties change in time.

20. A method for pulse-by-pulse optical absorption measurement, comprising the steps of:

(a) providing a cavity;

(b) delivering a pulse into said cavity;

(c) time resolving at least one response pulse produced by said cavity in response to said pulse; and

(d) detecting an intensity of said at least one response pulse.

21. The method of claim 20, wherein said step of delivering a pulse, comprises the step of:

providing a means for delivering an ultra short pulse into said cavity.

22. The method of claim 21, wherein said step of time resolving said at least one response pulse, comprises the step of:

time resolving at least one ultra short response pulse produced by said cavity in response to said ultra short pulse.

23. The method of claim 22, wherein said step of detecting said at least one response pulse comprises the step of:

detecting said at least one ultra-short response pulse.

24. The method of claim 22, wherein said step of time resolving at least one response pulse comprises the step of:
providing a nonlinear medium for mixing said at least one ultra short response pulse with a resolving pulse.

25. The method of claim 24, wherein said resolving pulse is a chirped pulse.

26. The method of claim 20, wherein said at least one response pulse is a train of response pulses.

27. The method of claim 26, wherein step of detecting further comprises the step of comparing at least two response pulses from said train of response pulses.

28. The method of claim 20, wherein said step of detecting further comprising the step of:
providing an extracting means for analyzing said at least one response pulse.

29. The method of claim 20, wherein said step of providing a cavity, comprises the step of:
providing a linear cavity with a predetermined cavity length set to resolve said at least one response pulse at said detector.

30. The method of claim 29, wherein said predetermined cavity length is on the order of micrometers to set a time regime of said at least one response pulse on the order of femtoseconds.

31. The method of claim 29, wherein said predetermined cavity length is on the order of millimeters to set a time regime of said at least one response pulse on the order of picoseconds.

32. The method of claim 29, wherein said predetermined cavity length is on the order of meters to set a time regime of said at least one response pulse on the order of nanoseconds.

33. The method of claim 29, wherein said step of providing a linear cavity, comprises the step of:
providing at least one low reflector.

34. The method of claim 20, wherein said step of providing a cavity, comprises the step of:
providing a non-linear cavity with a predetermined cavity length set to resolve said at least one response pulse at said detector.

35. The method of claim 34, wherein said predetermined cavity length is on the order of micrometers to set a time regime of said at least one response pulse on the order of femtoseconds.

36. The method of claim 34, wherein said predetermined cavity length is on the order of millimeters to set a time regime of said at least one response pulse on the order of picoseconds.

37. The method of claim 34, wherein said predetermined cavity length is on the order of meters to set a time regime of said at least one response pulse on the order of nanoseconds.

38. The method of claim 34, wherein said step of providing a linear cavity, comprises the step of:
providing at least one low reflector.

39. The method of claim 20, further comprising the step of:
providing a changing absorption sample within said cavity.